

4.3 Analysis

Signal timing analyses were performed using Synchro, a nationally accepted computer software package. This software has been used widely to perform capacity analyses and develop optimized signal timing plans, including signal timing splits, cycle lengths, offsets, and lead-lag phasing sequences.

Using the new turning movement data collected by The Schemmer Associates (TSA) as well as existing data from the City of Lincoln Public Works and Utilities Department, optimal operating conditions were then evaluated in a three-step process:

Step 1. Existing Cycle and Existing Phase Sequence

The operating conditions under the existing signal timing and revised turning movement volumes were observed.

Step 2. Optimized Cycle and Existing Phase Sequence

In order to begin the analysis process, a sub-system evaluation was first conducted for each analysis corridor. This analysis is based on factors such as the distance between intersections, cross street traffic volumes, and other coordinated corridors within the City of Lincoln signal system. Figure 7 illustrates the sub-system boundaries for the six analysis corridors.

For each corridor/sub-system, cycle lengths between 50 and 150 seconds were analyzed. In choosing the most optimum cycle length, the following factors were taken into consideration:

1. System-wide coordination
2. Proximity of study corridors to other major corridors in the system
3. Intersection turning movement volumes
4. Individual intersection delay and LOS
5. Approach delay per movement for each intersection

In order to provide an efficient flow of traffic, it is important to provide a cycle length that would provide sufficient green time to be capable of serving all movements. However, long cycle lengths generally result in high delays for the minor approaches. Consideration is given to all of the above factors in determining the optimum cycle length.

System-wide coordination is accomplished by using a similar cycle length throughout the system. In the analysis, if the optimal cycle lengths chosen were within a few seconds of the existing cycle lengths, and the optimization did not make a significant improvement to the intersection operations, the existing cycle length was retained. Comparisons were made between existing and proposed signal timing plans using various measures of effectiveness (MOEs). Examples of MOEs include bandwidth lengths in both directions,

flow diagrams, and approach delays. Table 23 summarizes the “before” and “after” cycle lengths for each of the sub-systems.

Step 3. Optimized Cycle and Optimized Phase Sequence and Offsets

The final step in the analysis process was to calculate the optimum signal timing splits to provide sufficient green time for each movement so that the maximum number of the vehicles would be served. In addition, offsets were optimized to provide the most efficient coordination with the widest bandwidth.

The following is a brief description of each study corridor and the analysis procedure.

North 27th Street

The optimization of signal timings for South 27th Street was conducted as part of the previous phase of this project. Due to the high vehicular trips along 27th Street between Old Cheney and Superior Street, and its importance to the City of Lincoln’s overall traffic flow, North 27th Street was added to the list of corridors to be analyzed as part of this phase of the project. The intersection of 27th Street at “O” Street operates as part of the “O” Street signal system. As a result, the southern-most intersection of the North 27th Street sub-system was chosen to be 27th / “O” Street. Due to traffic flow pattern changes during all three study periods and the large distance between intersections (approximately 4,000 feet between the intersections of 27th / Fair Streets and 27th Street / Cornhusker Highway), Cornhusker Highway was chosen to be a natural breaking point. Similarly, due to the large distance between the intersections of 27th / Fairfield Streets and 27th / Superior Streets (approximately 3,500 feet), the intersections north of Superior Street serve as a separate sub-system.

North 48th Street

Similar to the 27th Street corridor, traffic signal coordination continuity was one of the reasons to continue the coordination along 48th Street north of “O” Street. With the inclusion of North 48th Street, this continuity is possible. Due to the relationship between North 48th Street and the Holdrege Street and 33rd Street corridors, special attention was given to the effects this analysis had on these previously analyzed corridors. Due to the large distance between the intersections of 48th / Holdrege Streets and 48th Street / Leighton Avenue (approximately 2,650 feet), this area was chosen to be a natural break point. The intersections of 48th / Superior Streets and 48th Street / Cornhusker Highway operate under separate systems and were not included in the sub-system north of Leighton Avenue.

North 70th Street

The 70th Street Corridor is the eastern-most corridor that will be analyzed for signal timing as part of this phase of the project. This corridor has, and will continue to experience traffic growth due to growth and expansion of the City. As a result, it was important to conduct a thorough analysis of this corridor. The 70th Street corridor was not broken into separate sub-systems. Rather, it was optimized as one single system. The signal timing plans for this corridor were developed following the development of the signal timing plans for the North 27th, North 48th and Vine Street corridors.

Vine Street

Vine Street is a major east/west corridor connecting the three north/south study corridors (27th, 48th, and 70th Street Corridors). In analyzing these corridors, the 27th Street corridor was analyzed first, since it has higher traffic volumes than the other corridors. Once the timings along 27th Street had been developed, signal timing plans for the Vine Street corridor were developed. Due to the large distance between 33rd Street and 45th Street, the Vine Street corridor was divided into two sub-systems between these two intersections

Nebraska Highway 2 and Pioneers Boulevard

During the AM Peak, peak traffic flow is in the westbound direction. In addition, high northbound-to-westbound left-turn volumes exist at the intersections of 27th Street/Hwy 2 and 40th Street/Hwy 2. These high volumes result from the densely populated residential neighborhoods south of Highway 2 and the large employment centers in north and northwest Lincoln, including Downtown Lincoln. In developing the new signal timings along Highway 2, these high left-turn volumes played an important role in the analysis. In addition, it was important to develop a signal timing pattern such that vehicles merging from Pioneers Boulevard onto Highway 2 do so safely and do not conflict with platoons of vehicles traveling westbound along Highway 2.

Similar travel patterns are evident during the Midday time period, however, at lesser levels. During the PM Peak, the reverse commute occurs. That is, vehicles travel from Downtown Lincoln to the residential neighborhoods in the south. This is evident in the high eastbound-to-southbound right-turn volumes from Highway 2 onto 27th and 40th Streets.

Due to the close proximity of the intersections of 48th Street/Old Cheney Road, 56th Street/Old Cheney Road and 27th Street/Woods Boulevard to the Nebraska Highway 2 corridor, signal operations at these intersections were also included in this analysis. Neither of these two corridors were divided into smaller subsystems.